SCR

C38

14859

The C38 Silicon Controlled Rectifier is a three junction semiconductor device for use in power switching and control applications requiring a blocking voltage of 500 volts or less and RMS Forward Currents up to 35 amperes. Because of its higher Junction Temperature Rating than the C35 (2N681-92) series, it will prove useful in applications calling for higher ambient temperatures or smaller heat sinks than the C35 series permits.

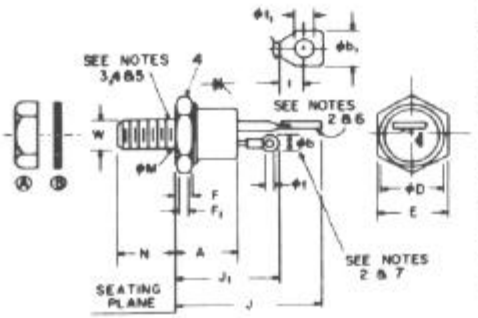
- **No Peak Forward Voltage Limitation**
- **Thermal Fatigue Free**
- **High Junction Temperature (150°C)**
- **Standard TO-48 Outline**
- **Long Creepage Path**
- **Low Thermal Resistance**

OUTLINE DRAWING

(COMPLIES WITH JEDEC TO-48)

NOTES:
1. Complete threads to extend to within 2½ threads of seating plane. Diameter of unthreaded portion .249" (6.32MM) Maximum, .220" (5.59MM) Minimum.
2. Angular orientation of these terminals is undefined.
3. ¼-28 UNF 2A. Maximum pitch diameter of plated threads shall be basic pitch diameter .2268" (5.76MM), minimum pitch diameter .2225" (5.66MM), reference screw thread standards for Federal Service 1957, Handbook H28, 1957, P1.
4. A chamfer (or undercut) on one or both ends of hexagonal portions is optional.
5. Case is anode connection.
6. Large terminal is cathode connection.
7. Small terminal is gate connection.
8. Insulating kit available upon request.
A. ¼-28 steel nut, Ni plated, .178 min. thk.
B. Ext. tooth lockwasher, steel, Ni plated, .023 min. thk.

(COMPLIES WITH JEDEC TO-48)



SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
A	.330	.505	8.38	12.83	
Øb	.115	.140	2.92	3.56	2
$Øb_1$	.210	.300	5.33	7.62	2
ØD		.544		13.82	
E	.544	.562	13.82	14.27	
F	.113	.200	2.87	5.08	4
F_1	.060		1.52		
J		1.193		30.30	
J_1		.875		22.23	
T	.120		3.05		
ØM					1
N	.422	.453	10.72	11.51	
Ød	.060	.075	1.52	1.91	
$Ød_1$	.125	.165	3.18	4.19	
W					3

Type	Minimum Forward Breakover Voltage (V_{BO})* T_J = −65°C to +150°C	Repetitive Peak Reverse Voltage (PRV)* T_J = −65°C to +150°C	Transient Peak Reverse Voltage (Non-recurrent <5.0 Millisec.)* T_J = −65°C to +150°C
C38U	25 volts	25 volts	35 volts
C38F	50 volts	50 volts	75 volts
C38A	100 volts	100 volts	150 volts
C38G	150 volts	150 volts	225 volts
C38B	200 volts	200 volts	300 volts
C38H	250 volts	250 volts	350 volts
C38C	300 volts	300 volts	400 volts
C38D	400 volts	400 volts	500 volts
C38E	500 volts	500 volts	600 volts

*Values apply for zero or negative gate voltage only. Maximum case to ambient thermal resistance for which maximum PRV ratings apply — equals 11°C/watt.

MAXIMUM ALLOWABLE RATINGS

RMS Forward Current — 35 amperes (all conduction angles)

Average Forward Current (I_O) — Depends on conduction angle (see charts 3 & 5)

Peak One-cycle Non-recurrent Surge Current (i_{surge}) — 150 amperes

Peak Non-recurrent Surge Current during Turn-on time Interval — See Chart 10

I^2t (for fusing) — 75 ampere² seconds (for times ≧ 1.5 milliseconds)

Peak Gate Power (p_G) — 12 watts

Average Gate Power (P_G) — 0.5 watt

Peak Gate Current (i_G) — 2.0 amperes

Peak Gate Voltage (v_G) (Forward and Reverse) — 10 volts

Storage Temperature — −65°C to + 150°C

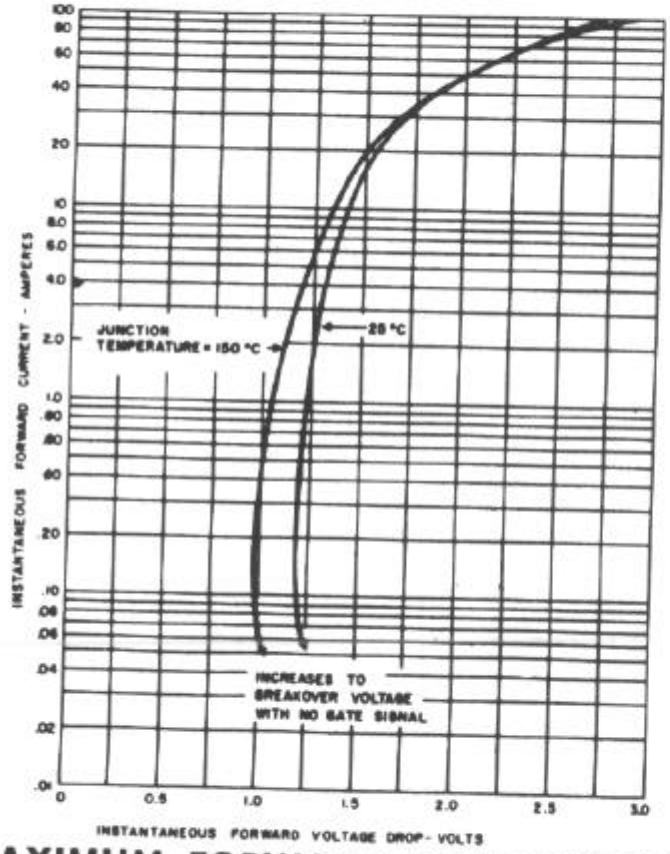
Operating Temperature — −65°C to + 150°C

Stud Torque — 30 inch-pounds

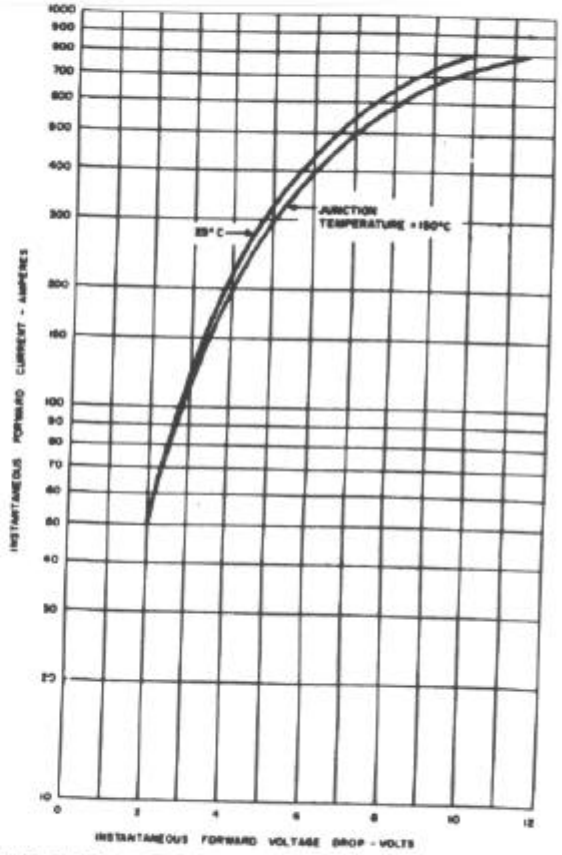
**NOT TO EXCEED GATE POWER RATINGS

						T_J = 100°C, I_F = 10a, I_R = 5a, v_{AC} (reapplied) = Rated, dv/dt = 20v/μsec Linear
Thermal Resistance	θ_{J-C}	——	.75	1.5	°C/watt	Junction to case

*Values apply for zero or negative gate voltage. Max. case to ambient thermal resistance for which max. PRV ratings apply = 11°C per watt.
**See Chart 8.


INSTANTANEOUS FORWARD CURRENT - AMPERES
JUNCTION TEMPERATURE = 150 °C
25 °C
INCREASES TO BREAKOVER VOLTAGE WITH NO GATE SIGNAL
INSTANTANEOUS FORWARD VOLTAGE DROP - VOLTS

1. MAXIMUM FORWARD CHARACTERISTICS CONDUCTING STATE

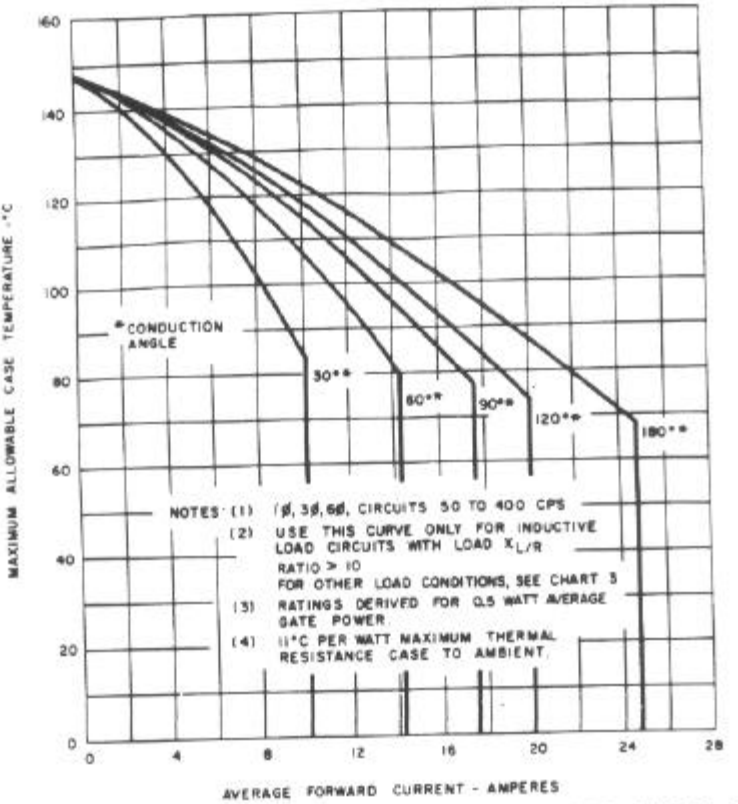


2. MAXIMUM FORWARD CHARACTERISTICS HIGH CURRENT LEVEL—CONDUCTING STATE

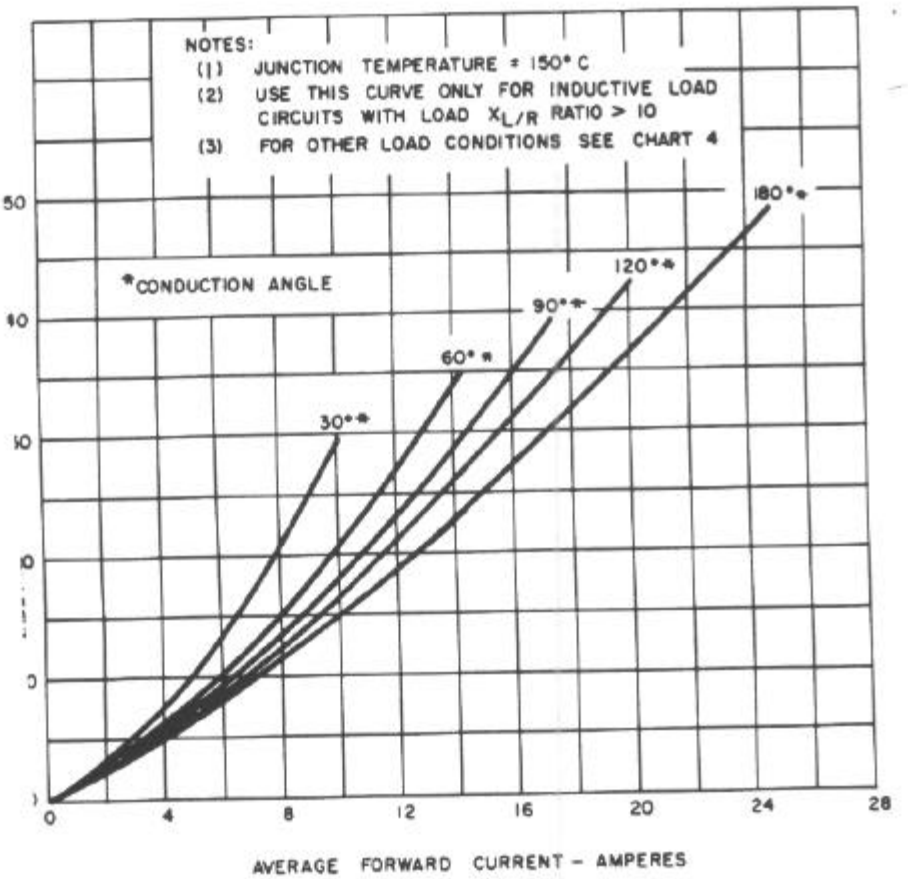
CHARACTERISTICS

Test	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Peak Reverse and Forward Blocking Current*	i_R and i_S					T_J = 25°C
C38U		—	6.0	10.0	ma	$V_{AC} = V_{CA}$ = 25v peak
C38F		—	5.5	10.0	ma	50
C38A		—	5.0	10.0	ma	100
C38G		—	4.5	10.0	ma	150
C38B		—	4.0	8.0	ma	200
C38H		—	3.0	6.0	ma	250
C38C		—	2.5	5.0	ma	300
C38D		—	2.0	4.0	ma	400
C38E		—	1.5	3.0	ma	500
Peak Reverse and Forward Blocking Current*	i_R and i_S					T_J = 150°C
C38U		—	9.0	13.0	ma	$V_{AC} = V_{CA}$ = 25v peak
C38F		—	8.9	13.0	ma	50
C38A		—	7.8	13.0	ma	100
C38G		—	7.7	13.0	ma	150
C38B		—	7.5	12.0	ma	200
C38H		—	7.3	11.0	ma	250
C38C		—	6.8	10.0	ma	300
C38D		—	5.3	8.0	ma	400
C38E		—	2.6	6.0	ma	500
Rate of Rise of Forward Voltage that Will Not Turn on SCR**	dv/dt	20.0	40.0	—	volts/ μsec	T_J = 150°C. Gate open circuited. V_{AC} = Rated.
Gate Current to Fire	I_{GF}	—	15	40	mAdc	T_J = 25°C, V_{AC} = 6 Vdc, R_L = 50 ohms
		—	35	80	mAdc	T_J = −65°C, V_{AC} = 6 Vdc, R_L = 50 ohms
		—	7.5	20	mAdc	T_J = 150°C, V_{AC} = 6 Vdc, R_L = 50 ohms
Gate Voltage to Fire	V_{GF}	—	1.2	3.0	Vdc	V_{AC} = 6 Vdc, T_J = 25°C, R_L = 50 ohms
		—	2.0	3.0	Vdc	V_{AC} = 6 Vdc, T_J = −65°C, R_L = 50 ohms
		0.15	—	—	Vdc	V_{AC} = Rated, T_J = 150°C, R_L = 1000 ohms
Forward Voltage Drop	V_F	—	1.7	2.0	v	i_F = 50a peak, T_J = 25°C
Holding Current	I_H	—	10	80	mAdc	T_J = 25°C, Anode Supply = 6 Vdc
Turn-on Time	$t_d + t_r$	—	1.4	—	μsec	T_J = 25°C, I_F = 5.0 Adc, V_{AC} = Rated. Gate supply: 10 volt open circuit, 25 ohm, 0.1 μsec. max. rise time.
Turn-off Time	t_{off}	—	24	—	μsec	T_J = 150°C, i_F = 10a, i_R = 5a, V_{AC} (reapplied) = Rated, dv/dt = 20v/μsec Linear
Thermal Resistance	θ_{J-C}	—	.75	1.5	°C/watt	Junction to case

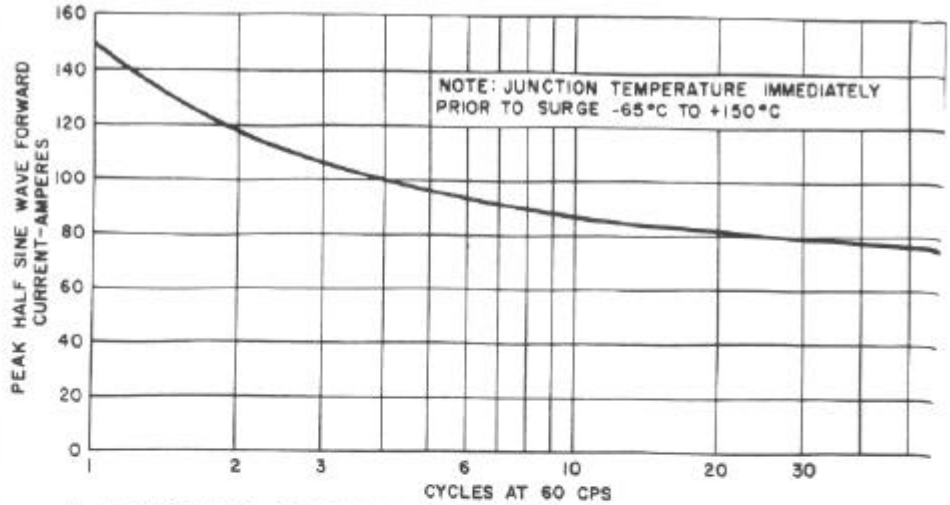
...gate voltage. Max. case to ambient thermal resistance for which max. PRV ratings apply = 11°C per watt.



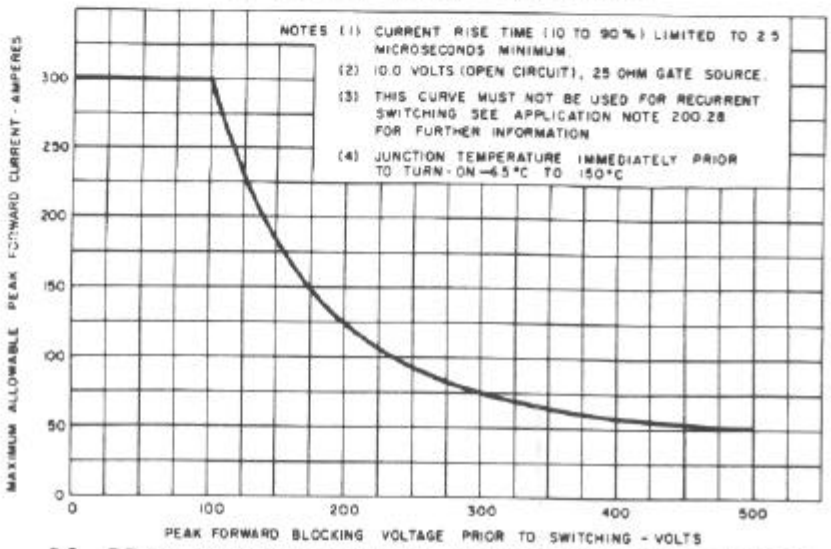
5. MAXIMUM ALLOWABLE CASE TEMPERATURE FOR RECTANGULAR CURRENT WAVEFORM



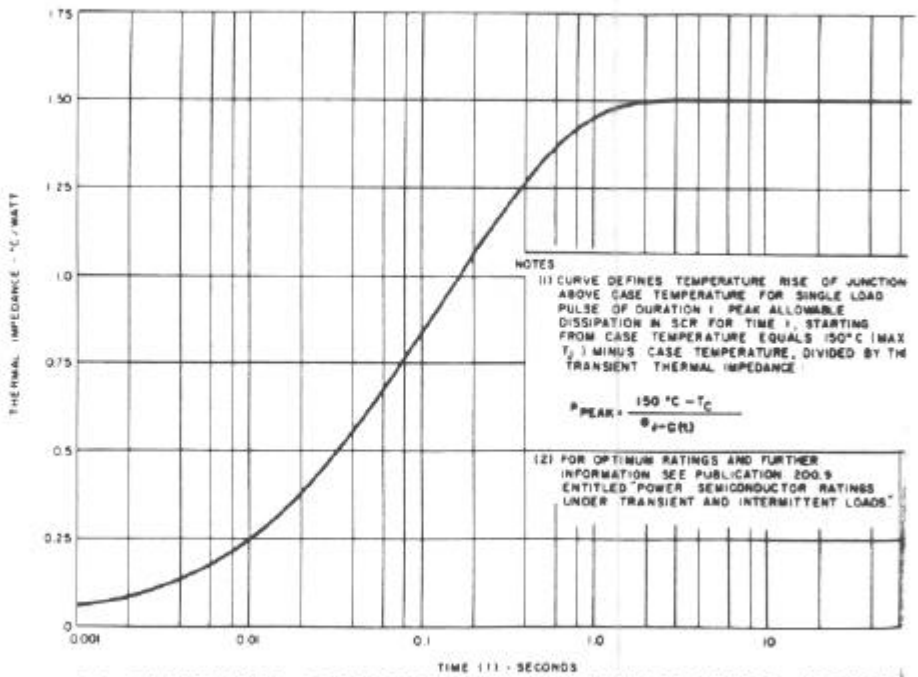
6. FORWARD POWER DISSIPATION FOR RECTANGULAR CURRENT WAVEFORM



9. MAXIMUM ALLOWABLE NON-RECURRENT SURGE CURREN AT RATED LOAD CONDITIONS


MAXIMUM ALLOWABLE PEAK FORWARD CURRENT - AMPERES
300
250
200
150
100
50
0
NOTES (1) CURRENT RISE TIME (10 TO 90%) LIMITED TO 2.5 MICROSECONDS MINIMUM.
(2) 10.0 VOLTS (OPEN CIRCUIT), 25 OHM GATE SOURCE.
(3) THIS CURVE MUST NOT BE USED FOR RECURRENT SWITCHING SEE APPLICATION NOTE 200.28 FOR FURTHER INFORMATION
(4) JUNCTION TEMPERATURE IMMEDIATELY PRIOR TO TURN-ON -65°C TO 150°C
0
100
200
300
400
500
PEAK FORWARD BLOCKING VOLTAGE PRIOR TO SWITCHING - VOLTS

10. PEAK NON-RECURRENT SURGE CURRENT DURING TURN-ON TIME INTERVAL


THERMAL IMPEDANCE - °C/WATT
1.75
1.50
1.25
1.0
0.75
0.5
0.25
0
NOTES
(1) CURVE DEFINES TEMPERATURE RISE OF JUNCTION ABOVE CASE TEMPERATURE FOR SINGLE LOAD PULSE OF DURATION t. PEAK ALLOWABLE DISSIPATION IN SCR FOR TIME t, STARTING FROM CASE TEMPERATURE EQUALS 150°C (MAX T_J) MINUS CASE TEMPERATURE, DIVIDED BY THE TRANSIENT THERMAL IMPEDANCE.
$P_{PEAK} = \frac{150\,°C - T_C}{\theta_{J-C}(t)}$
(2) FOR OPTIMUM RATINGS AND FURTHER INFORMATION SEE PUBLICATION 200.9 ENTITLED "POWER SEMICONDUCTOR RATINGS UNDER TRANSIENT AND INTERMITTENT LOADS"
0.001
0.01
0.1
1.0
10
TIME (t) - SECONDS

11. MAXIMUM TRANSIENT THERMAL IMPEDANCE JUNCTI TO CASE